Citation:

Azadbakht L, Mirmiran P, Esmaillzadeh A, Azizi F. Dairy consumption is inversely associated with the prevalence of the metabolic syndrome in Tehranian adults. *Am J Clin Nutr.* 2005 Sep; 82(3): 523-530.

PubMed ID: 16155263

Study Design:

Cross-Sectional Study

Class:

D - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To ascertain the relation between dairy consumption and metabolic syndrome in a representative sample of Tehranian adults.

Inclusion Criteria:

- Men and women aged 18 to 74 years
- Participants in the Tehran Lipid and Glucose Study (TLGS), a prospective study of a representative sample of residents of District 13 of Tehran, Iran.

Exclusion Criteria:

- Subjects with a history of cardiovascular disease (CVD), diabetes or stroke
- Subjects whose reported daily energy intakes were outside of the range of 800 to 4,200kcal per day (3,347 to 17,573kJ per day).

Description of Study Protocol:

Recruitment

- The current study was conducted within the framework of the Tehran Lipid and Glucose Study (TLGS), a prospective study of a representative sample of residents of District 13 of Tehran, Iran
- In the TLGS, 15,005 persons aged more than three years were selected by a multistage cluster, random sampling method
- A representative sample of 1,476 persons were randomly selected for dietary assessment, including 861 subjects aged 18 to 74 years.

Design

Population-based cross-sectional study.

Statistical Analysis

- In separate models, first-order interactions between sex and dairy intakes were entered to ascertain whether associations were similar between men and women
- Cutoffs for quartiles of dairy intake were calculated, and subjects were categorized according to the quartiles: less than 1.0, 1.0 to less than 1.8, 1.8 to less than 2.7, and more than 2.7 servings per day
- Significant differences in general characteristics across quartiles of dairy intake were searched by using one-way ANOVA
- Tukey test was used to detect pairwise differences
- Chi-square test was used to detect any significant differences in the distribution of subjects across quartiles of dairy intake with regard to qualitative variables
- Multivariate-adjusted means were determined for metabolic risk factors and determined age-, sex- and energy-adjusted means for dietary variables across quartiles of dairy intake by using a general linear model ANCOVA with the Tukey test to compare the means
- All correlations were calculated as Pearson's correlation coefficients
- Multivariate logistic regression adjusted for lifestyle and nutritional confounders was used in four models
- The Mantel-Haenszel extension chi-square test was performed to assess the overall trend of an increasing quartile of dairy intake associated with an increasing or decreasing likelihood of being classified as high risk.

Data Collection Summary:

Timing of Measurements

One-time measurement.

Dependent Variables

- Height measured with tape measure, weight measured with digital scales, BMI calculated
- Waist circumference (WC) measured with outstretched tape measure
- Blood pressure (BP)
- Fasting blood samples for the measurement of glucose and lipid concentrations
- Prevalence of metabolic syndrome: Metabolic syndrome defined according to guidelines of the Adult Treatment Panel III (ATPIII).

Independent Variables

- Dairy consumption
- Usual dietary intake was assessed with the use of a 168-item semi-quantitative food-frequency questionnaire (FFQ), consisting of foods with a standard serving size.

Control Variables

- Age
- Energy intake
- Percentage of energy from fat
- Smoking habits

- Physical activity
- Medical history
- Use of medications
- Current estrogen replacement therapy among women.

Description of Actual Data Sample:

- *Initial N:* 1,476 persons were randomly selected for dietary assessment, including 861 subjects aged 18 to 74 years
- *Attrition (final N):* After application of exclusion criteria, 827 subjects (357 men, 470 women)
- *Age:* 18 to 74 years
- *Location:* Tehran, Iran.

Summary of Results:

Key Findings

- Mean consumption of milk, yogurt and cheese was 0.7±0.2, 1.06±0.6 and 0.9±0.3 servings per day, respectively
- The frequency of metabolic syndrome and its components was highest in quartile one of dairy consumption
- Subjects in the highest quartile of dairy consumption had lower odds of having enlarged WC (OR by quartile: One, 0.89, 0.74, 0.63, P<0.001), hypertension (OR by quartile: One, 0.88, 0.79, 0.71, P<0.02) and metabolic syndrome (OR by quartile: One, 0.83, 0.74, 0.69, P<0.02)
- The values of odds ratios became weaker after further adjustment for calcium intake.

Multivariate-adjusted Means for Components of the Metabolic Syndrome

Variables	Qaurtile 1 (N=206) Less than 1.7 Servings	Quartile 2 (N=204) 1.7 to Less than 2.3 Servings	Quartile 3 (N=210) 2.3 to Less than 3.1 Servings	Quartile 4 (N=207) More than 3.1 Servings	P for Differences Across Quartiles
Waist girth (cm)	81±1	79±1	77±1[3]	76±1[4]	<0.04
HDL-C (mg per dL)	42±0.4	43±0.4	43±0.3	49±0.3[5]	<0.02
Fasting blood glucose (mg per dL)	96±0.6	95±0.7	94±0.6	95±0.6	0.18
Systolic blood pressure (mmHg)	128±1[5]	120±1[6]	114±1	112±1	<0.03

Diastolic blood pressure (mmHg)	89±0.6[6]	86±0.6[7]	84±0.6	83±0.5	<0.03

[3]Significantly different from the first quartile, P<0.05.

[4]Significantly different from the first quartile, P<0.01.

[5]Significantly different from the other quartiles, P<0.01.

[6]Significantly different from the third and fourth quartiles, P<0.05.

[7]Significantly different from the fourth quartile, P<0.01.

Author Conclusion:

- In conclusion, we found evidence indicative of an inverse relation between dairy consumption and metabolic syndrome
- It is recommended that future studies assess this issue further by addressing the components of dairy products and related mechanisms of action that are responsible for this effect.

Reviewer Comments:

Authors note the following:

- *Butter and ice cream were not included in the analysis due to high fat content*
- *Since subjects with known CVD, diabetes or stroke were excluded, this may have reduced the likelihood of finding significant trends in the odds of metabolic risks across quartiles of dairy consumption.*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	N/A
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	N/A

Validity Questions		
1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	Yes
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	Yes
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	Yes
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	Yes

4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	Yes
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	Yes
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	N/A
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	N/A
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes

7.1.	Were primary and secondary endpoints described and relevant to the question?	N/A
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	N/A
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes